4. Engineering-geological regionalization of the territory of the construction site was performed on the basis of morphology, geological structure, hydrogeological characteristics, tectonic and neotectonic occurrences, and physical and mechanical properties of the soils. This made it possible to successfully select the site for the structures of the diversion-service spillway and powerhouse, having laid out those of them that are the heaviest and most sensitive to nonuniform displacements on a single structural-tectonic block.

5. It is necessary to regard the Shamkhor hydro development as an analogue-object with respect to composition, volume, and direction of the surveys and investigations performed, and the results obtained during geological substantiation and documentation and of the research works can be used when designing the Enikend, Kirzan, and Alazan hydro developments located in this region.

HYDROPOWER ENGINEERING OF THE NORTHERN CAUCASUS

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The maximum use of all types of local energy resources, including water, in the territory of the European part of the country is of ever greater interest for development of the economy.

The hydropotential of the European sector of the USSR with the Caucasus and its expected use in the near future are given in Table 1 [1].

Of the 25 billion kWh of economically effective hydropower resources of the Northern Caucasus, 6.1 billion kWh is being utilized at operating hydrostations. An additional seven stations are being constructed, the total production of which will be 4.1 billion kWh. With their start-up the use of the economic hydropotential of the Northern Caucasus will reach 42%. About 15 billion kWh will still remain undeveloped, including 9 billion kWh in the basin of the Terek River, 3 billion kWh in the basin of the Sulak River (Andiiskoe and Avarske Koisu), and the remainder on the Kuban and Samur rivers.

In recent years the All-Union Planning, Surveying, and Scientific-Research Institute (Gidroprojekt) refined the economic hydropotential of the Northern Caucasus.

The studies showed that according to the current estimate, another 42 hydrostations (in addition to those now operating and under construction) with a total production of 12 billion kWh can be assigned to the category of economic potential.

The specific capital investments for these stations with consideration of the multipurpose effect are less than or do not exceed by more than 20% the maximum allowable specific capital investments for hydrostations of this region (325-725 rubles/kW, depending on the annual number of hours of use of the installed capacity).

Terek River Basin. As is seen from Table 1, the economic hydropotential of the Terek River was earlier estimated to be 9.8 billion kWh, of which 1.3 billion kWh will be realized by the existing and a building (Zaramag) hydrostations. Further development of the economy in the Terek basin requires the creation primarily of regulating reservoirs for water-management needs, the total useful storage of which in a number of project studies is estimated to be 2 km³. The existing hypothesis of the development of water management of the basin calls for the creation of such reservoirs as the Terek-Malka and Kurb on the middle stretch of the river and the Khamamat-Yurt in the lower course. These reservoirs should reregulate the excess runoff of the fall-winter period for its use in the summer.

Under these conditions the accomplishment of power regulation in the upper reaches of the basin on the tributaries of the Terek River necessitates referring to the estimate of the hydrostations the cost of increasing the storage of the downstream reservoirs, as was stipulated, for example, by the project of the Zaramag hydrostations.

The construction of the downstream regulating reservoirs substantially reduces the economic effectiveness of development of the hydropotential of the upper part of Terek basin. Calculations by Gidroprojekt show that on tributaries of the Terek—Urukh, Argun, Assa, Che-
rekon, etc. — regulating reservoirs with a total useful storage of less than 500 million m³ can be constructed in mountainous regions. The combined economic effectiveness of these reservoirs with consideration of the power effect will be not lower, and possibly even higher, than that of reservoirs of the middle and lower courses of the river. The hydrostations of these hydrodevelopments will operate according to an irrigation-fishery schedule, which leads to a decrease of their power production, but the loss will not exceed 5-10%. Under current conditions, when the fuel component is acquiring an ever greater weight in the criteria of evaluating the economic effectiveness of power installations, such a solution can be economically justified.

In connection with this, in the author's opinion, it is necessary to return again to an examination of the question of siting the regulating reservoirs in the Terek basin in the scheme of multipurpose use of the river.

With appropriate correction of the designs, the Dar'yal and Dzerakh hydrostations on the main trunk of the Terek River and stations as part of the Kurp hydrotechnical complex are rather prospective. The main indices of these hydrostations are given in Table 2.

The Dar'yal hydrostation is being considered without a regulating reservoir, with a small daily storage basin, i.e., without flooding the Terek valley. As in previous studies, special channel releases in the stretch of the diversion of the Dar'yal hydrostation are provided for in the tourist season.

The energy potential of the Ardon River (a tributary of the Terek) is 2.8 billion kWh. Of this amount, 852 million kWh will be realized at the Zaramag hydrostations under construction (head hydrostation 63 million kWh and hydrostation-I 789 million kWh) using a head of 677 m. Below this stretch still another hydrostation can be built — the Zaramag II with a capacity of 90-140 MW and production of 200-300 million kWh, the effectiveness of which will depend to a considerable extent on the possibility of using the side streams entering below hydrostation-I.

On the Urukh River it is possible to construct a cascade of two hydrostations — the Digora-I with a regulating reservoir with a useful storage of 150 million m³ and downstream of it the Digora-II with a daily storage counterpool. The total capacity of the indicated hydrostations is 200 MW and power production 740 million kWh with the hydrostations operating on an irrigation schedule. Such a project will be multipurpose and for its detailed substantiation it is necessary to develop a "Scheme of the Multipurpose Use of the Urukh River."

With respect to the Cherek River, the scheme of using the water resources (1977) called for constructing a sequence of six hydrostations with a total capacity of 2700 MW, including the 700-MW Vysokogornoe pumped-storage station; the production of all hydrostations of the cascade is 1.6 billion kWh. Additional studies showed that it is more advisable to start the construction of the cascade from the two lower steps — the Aushiger and Sovetskoe hydrosta-